

# PLANNING FOR MULTIPLE-USE MANAGEMENT OF NEW ZEALAND'S BEECH (*NOTHOFAGUS* SPP.) FORESTS

A. P. THOMSON, A. KIRKLAND, and K. H. MIERS\*

## INTRODUCTION

The wood resources and productive potential of New Zealand's temperate hardwood forests have in the past been badly under-utilized. Harvesting has been largely confined to removing only the highest quality logs, leaving many inferior trees standing and much pulpwood on the forest floor. In the considerable areas of mixed forests, hardwood logging has been incidental to the recovery of the softwoods (mainly *Podocarpus* spp.). This highly selective logging has left large volumes of potentially utilizable wood on cut-over areas, which in turn has increased the difficulty of producing second crops, whether indigenous or exotic.

The recent world-wide trend to increased use of hardwoods for pulp manufacture has led to the limited use of tawa (*Beilschmiedia tawa*) by the pulping industry of the North Island. Of more importance, it has focused attention on the large resources of beech (*Nothofagus* spp.) in the South Island, and on the possibility either of their being exported as chips or forming the basis for local pulp and paper industries.

This paper describes the steps which have been taken to plan for the possible management of about 2 million hectares of beech forests under the control of the New Zealand Forest Service. Two considerations were paramount in the planning approach:

- (1) A high proportion of the forests, possibly 90% are on steep hill and mountain country and are of primary importance for soil and water conservation. They also have a great scenic and tourist value and their preservation for this alone would be essential. They have other important uses for recreation, and as wildlife habitats. The significance of this part of New Zealand's large forest estate for multiple use now and in the future would be hard to overestimate. Thus the first step in planning consisted of classifying or zoning forests into categories which should be reserved for these reasons and the residue which could be considered for utilization and possible conversion to exotics.
- (2) There is heightened public interest in environmental values and in the conservation of natural resources. Despite the confidence of the forestry profession that it

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\*Director-General of Forests, Director of the Forest Management Division, and Director of the Environmental Forestry Division, N.Z. Forest Service.

is both responsible and knowledgeable enough to persevere these environmental values and to manage the forests on conservation grounds, it was considered essential to reveal plans and policies to interested organizations and to the public generally so that representations could be made to the Government before any decisions were taken. This was done in the form of a paper submitted by the Director-General of Forests to the Minister of Forests and tabled in Parliament. It has resulted in a critical and detailed examination of Forest Service proposals which is quite unprecedented in New Zealand's forest history.

### THE SOUTH ISLAND BEECH FORESTS

The area of indigenous forest in New Zealand in 1830, prior to intensive European settlement, is estimated to have been 11.3 million hectares. This has been reduced to 5.7 million hectares at the present time, largely as a result of clearing for livestock farming in the last half of the 19th century and in the early 1900s.

There remain in the South Island some 3.4 million hectares of native forests, covering almost a quarter of the land area. They extend from sea level to altitudes of 1,100 to 1,500 m in an almost unbroken tract along the western flank of the island and in pockets east of the main range. Of the total area of 3.4 million hectares about 1.9 million hectares are administered as State forests by the Forest Service and 0.85 million hectares are in National Parks and other reserves.

The distribution of forest types in the South Island is complex and is related to altitude, latitude, soils, past and present climate, and recent geological history. In broad terms the warmer, moister sites carry podocarp-dominated forests and the cooler or drier sites beech-dominated forests. In the lowland there is, however, considerable overlap of these two major types and consequently a wide range of beech-podocarp mixtures. The upland forests are largely beech-dominated and are entirely hardwood-dominated. Pure or mixed beech stands make up 80% by area of South Island forests.

The lowland beech forest estate was originally much larger, but considerable areas have been felled for conversion to farmland with varying degrees of success. With the exception of some valley floor types beech forests do not occupy good agricultural soils and the land which used to be in beech is now generally in rough pasture, exotic forest, or gorse (*Ulex europaeus*) and bracken (*Pteridium aquilinum* var. *esculentum*).

In some areas the cleared beech forest lands carried good pastures immediately after burning, but fertility has since declined. In the Nelson-Marlborough region such land is being reforested in exotic softwoods, mainly *Pinus radiata*, by the State and the private sector. To date about 40,000 ha have been restored in this way and thriving industries have been built up on the forests so created.

The main mountain mass of the South Island extends from Marlborough in the north-west to Fiordland in the south-east

and rises to 4,000 m above sea level. This alpine chain and the lesser flanking ranges are largely clothed by beech and rata-kamahi protection forests, the overriding value of which is soil and water protection. The protection forests are largely intact on the moist western fall of the main range, but in the eastern rainshadow their destruction by fire and subsequent grazing by domestic and feral animals have induced massive local accelerated erosion.

In examining the South Island beech forest for the purpose of development or expansion of industry, three possible project areas were recognized — in Nelson, the West Coast, and Southland (see Fig. 1). The total area of State forest within these project areas was 1.3 million hectares.

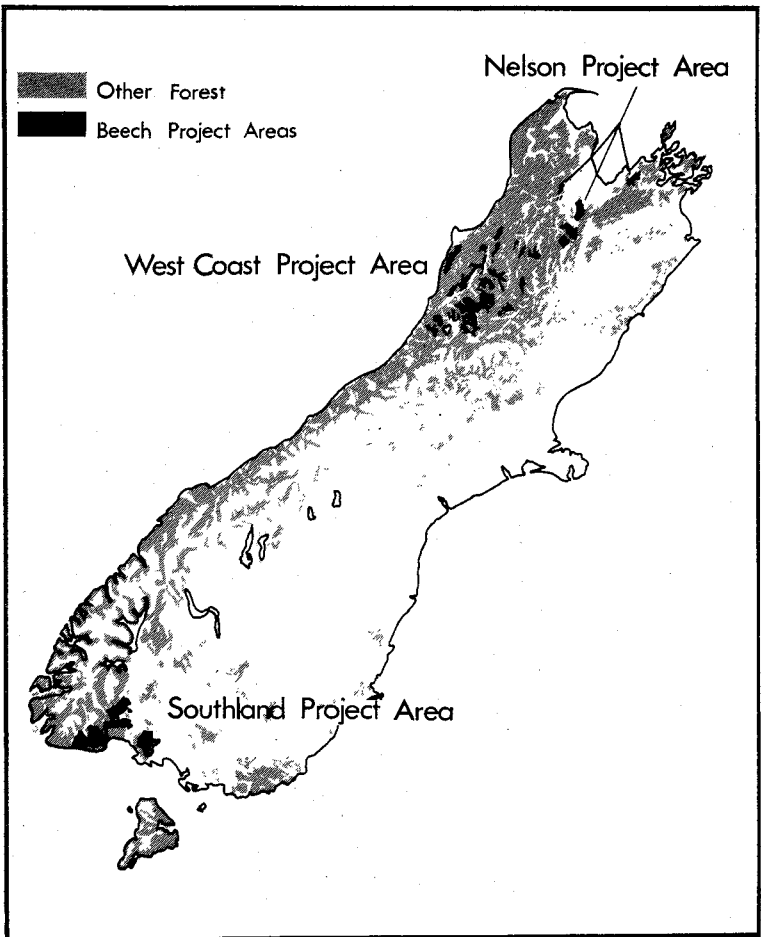


FIG. 1: South Island beech project areas.

## MANAGEMENT POTENTIAL

Two problems faced the Forest Service in assessing the productive potential of each of the project areas. The first was to define the area within each that could be logged without detriment to other values (or conversely, the area to be reserved from logging); the second was to determine the available volumes of wood on the loggable area so defined. Having determined the extent of the resource, it was intended, with Government approval, to call for industry proposals for its economic development.

## ZONING OF FORESTS

The first and most obvious step in zoning of forests for predominant future use was the delineation of the mountain and steepland forests to be preserved for the protection of soil and water values. No exploitation would be permitted in such forests. In the Nelson and West Coast project areas, all forests above about 820 m were zoned "protection forest". In Southland this limiting altitude was reduced to about 660 m. In addition, a limiting slope of approximately 26° was recognized. The generalized slope and altitude criteria require refinement in terms of forest, geological, and soil types but are adequate for initial estimates of potential in each area.

Most of the forest area not zoned as protection forest was potentially useful for wood production. However, it was recognized that a significant area should be preserved in its present condition for a number of reasons.

First, the scenery of the South Island is superb and the native forests contribute greatly to its unique character. Although reservation of the major panoramic forest back-drop had been ensured by the delineation of protection forests, much forest beside roads, rivers, and lakes was equally important scenically. Such areas together with undisturbed forest required for recreation were zoned as "amenity forests". Secondly it was regarded as essential to preserve examples of the range of lowland forest types for ecological study, and for their general biological interest to scientist and layman alike. In addition to preserving the flora, these "biological reserves" may become important havens for the native fauna, predominantly avian. In zoning such reserves it became apparent that the ecological requirements of the fauna were not well understood; in fact, there were few data even on the distribution of important species. Although logged and managed native forest could provide a suitable habitat for many bird species, the removal without replacement of, for example, drupe-bearing podocarps could have a profound effect on the number or even survival of others.

It was apparent that basic research and inventory would be needed for final delineation of biological reserves and the aid of specialists in the Department of Scientific and Industrial Research was obtained to augment the work of the Forest Research Institute.

The various forms of reserve are to be protected under a regional forest working plan approved by the Director-General of Forests and Minister of Forests. Those later identified as having outstanding scientific interest may be proclaimed forest sanctuaries under the Forests Act.

### ASSESSMENT OF THE UTILIZABLE RESOURCE

Following the initial zoning of reserves, an assessment was made of the volume of wood that might be available for utilization. Although the forests had been measured in the National Forest Survey some 20 years earlier, this had been aimed at estimating sawlog volumes and little information was available on likely pulpwood content. Assessment was based on a series of stratified systematic plots and results were computer processed. The timber on a number of plots was felled and measured on the ground: the results were used to correct the standing volume estimates.

The estimated utilizable resource in the three project area is:

	<i>Million cubic metres</i>				
Nelson ....	....	....	....	....	2.8-3.5
West Coast	....	....	....	....	28-34
Southland	....	....	....	....	14-17

The Nelson resource is insufficient in itself as a basis for a major industry. However, as previously stated, a large soft-wood plantation area, ultimately expected to exceed 75,000 ha, is being built up by the State and private enterprise, and the native forests should prove to be a valuable addition to this, possibly advancing major industrial development.

The Southland resource is considered too small to allow the development of a kraft pulp industry, with full recovery of chemicals, although some pulping processes cannot be ruled out. The resource could be augmented eventually by plantation-grown wood in the same way as in Nelson, but a good deep seaport, excellent transport facilities, and fertile land of easy topography not required for agriculture provide a favourable infrastructure for immediate development, perhaps of a chip export industry. Experience in regenerating beech forests, mainly silver beech (*Nothofagus menziesii*), is long standing in this region and, in the absence of introduced red deer (*Cervus elaphus*), few problems would be encountered in either perpetuating beech or converting logged forests to faster-growing exotic species.

The West Coast project, on the other hand, presents a number of major challenges to both the forester and industry. Management will be complicated by the variability of soil and forest types. Soils range from fertile alluviums in the main valleys to very strongly leached, acid, and infertile yellow-brown earths and gley podzols of low productivity on glacial moraine and outwash terraces. With the exception of farmed valleys and infertile "pakihī" lands, the area is forested and there is no open land suitable for augmenting the existing resource with plantations prior to utilization. The economy of

the region (dependent on farming the more fertile soils, on sawmilling based on native forests, and on mining) has been in decline and the Government has been concerned to strengthen it.

The region has great natural beauty and potential for major new developments in tourism.

The available volumes in the West Coast project area are sufficient to support a hardwood pulpmill and sawmilling and veneer plant, but the economics must be proven. Plans must be made to sustain whatever volume is required to commence an industry. It is probable that the manufactured produce will face a long haul to port and this will tend to favour the production of a high value commodity and large-scale production from the outset. In view of its greater complexity, briefly outlined above, the West Coast project area may be used to illustrate problems of initial planning for post-utilization forest management.

#### FOREST MANAGEMENT: THE WEST COAST PROJECT AREA AS AN EXAMPLE

The beeches are the most easily managed of New Zealand's commercial native tree species. Abundant seed fall, particularly after hot, dry summers, is recorded at 2- to 5-year intervals and some seed of red beech (*Nothofagus fusca*) and silver beech (*Nothofagus menziesii*) is set in most years. Seedlings survive best under shade and on exposed mineral soil. An advance growth of seedlings is not uncommon on the forest floor of mature stands, where it is persistent, although intolerant of shade, so that growth is extremely slow. However, upon removal of the canopy there is an immediate growth response to the increased light. Under optimum conditions a dense thicket of regeneration may be secured which, left to its own devices, will produce a stand of long-boled branch-free poles. Under these conditions untended pole stands might be felled for pulpwood at 40 to 50 years and produce a mean annual increment of about 3.5 m<sup>3</sup>/ha, and longer rotations might yield sawlog material and a mean annual increment in excess of 7.5 m<sup>3</sup>/ha. Thinning would reduce the time required to produce sawlog material but would require considerable care to avoid damage by pinhole borers (*Platypus* spp.) and might be difficult to support in terms of recovering additional costs. The rates of increment given above have been established in a limited number of well-stocked pole stands resulting from natural disasters or the removal of trees by gold-miners. They would almost certainly have to be reduced in estimating the likely sustainable cut from the whole resource because, first, it is unlikely that uniformly good regeneration would always be secured and, secondly, rates of growth could be less on the large areas of less fertile sites for which growth data are lacking.

Thus while it is theoretically possible to commence an industry on beech and to sustain it by managing beech forests, the sustainable volume would be difficult to predict and the investment risk for major industry accordingly high. Greater

certainty would be afforded by intensive management practices — *e.g.*, nursery-raised beech seedlings rather than seed-tree methods of regeneration, and early tending to accelerate growth of selected stems — but in a relatively slow-growing species these would reduce the economic viability of any proposal.

For these reasons it was not considered practicable to invite proposals which depended upon beech forests alone for sustaining supplies once the original volume had been utilized. The alternative was to convert at least part of the logged forest to faster-growing exotic trees, the return from which would be high enough to justify intensive management practices. Soils suitable for exotic plantation establishment occur on steeper hill country and less heavily podzolized "recent" terraces and are of variable fertility. Limited areas of West Coast hill soils have been established in exotic conifers over a period of 30 years and for a little over 10 years conversion of native forests to plantation has followed commercial logging. Although site indices of greater than 30 m at age 20 can be measured in most of the existing hill country plantations and mean annual increments of more than 20 m<sup>3</sup>/ha might be expected from *radiata* pine, it would again be unwise to extrapolate these findings to the wider area and it is unnecessary to do so. Delineation of areas suitable for conversion to exotic plantation (*i.e.*, with soils of reasonable fertility) showed that almost 100,000 ha were available and that supplies could thus be sustained from plantations growing at half the mean annual increment suggested above. A considerable safety factor would thus be built into sustention of wood supplies from plantations alone, and yields from logged and regenerated beech forest would further widen the safety factor. By assuring long-term supplies, establishment of plantations would allow the remaining beech forests to be managed as such on their merits — economic, aesthetic, recreational, etc. — without such values being distorted by the need for maximum wood production. The pressures for recreation in the lowland beech forests are light as yet and flexibility in their future management will be desirable in catering for whatever increased demand arises.

In the eastern portion of the project area close to the main alpine chain, pure red beech forests are found along the Maruia Valley and although soils are well suited to growing pine plantations they will be managed for beech. These beech forests would be more easily regenerated than many of the types further west, but above all they are an important part of the beautiful Lewis Pass-Maruia Valley entrance to the West Coast and thus should be maintained in a near-natural appearance for scenic and tourist purposes.

Techniques for conversion of logged native forest to plantations have been evolved over the last two decades. The light, one-man powersaw has allowed clearing of residual cover, and slash-burning techniques have been steadily refined. Logging to pulpwood standard should significantly reduce costs of preparing the site for planting.

The probable successes and difficulties of perpetuating beech forests are amply demonstrated in thousands of hectares of such forest already logged. Despite the susceptibility of seed trees to damage by insects (*Platypus* spp.) and to windthrow, adequate regeneration of all species is commonplace in cut-overs. The residual cover in cut-over is the fortuitous product of one or more selective loggings for preferred species. In some forest types regeneration of beeches has not been abundant. For example, in hard beech on hill country other hardwoods have dominated the regenerated crop. This is, however, of little significance if the aim is eventual production of pulpwood. Enrichment with compatible exotic hardwood species is envisaged where there is little chance of obtaining regeneration of beech or other productive species in sufficient quantity to form an eventual usable crop. Enrichment species must be browse-resistant — to introduced deer (*Cervus* spp.) and opossum (*Trichosurus vulpecula*) — and fast growing and those with greatest promise are eucalypts, particularly *Eucalyptus delegatensis*. This attractive tree harmonizes aesthetically in the beech forest and is capable of high productivity. Much of the area in which enrichment of this type might be practised is cut-over and the pattern of regeneration is already established. After the residual cover is logged and the existing seedlings released, the necessity or otherwise for enrichment should be clearly apparent. In logging virgin beech forests there will be less certainty, and enrichment as an insurance measure may be undertaken until the pattern of regeneration under pulpwood logging standards is clear.

A limited area of heavily podzolized glacial terrace carries high volume podocarp forest and will be logged with the intention of perpetuating podocarps. An even smaller area may be released for farming after logging.

The result of the above management consideration is an initial area breakdown of the West Coast project into:

	hectares
(1) Forests to be utilized and then:	
Managed for beech	35,000
Managed for beech with possible enrichment	84,000
Converted to plantation	97,000
Managed for podocarps	21,000
Released for farming	6,000
	<hr/> 243,000 <hr/>
(2) Forests to be reserved primarily for:	
Amenity, biological interest, etc.	30,000
Soil and water values	358,000
	<hr/> 388,000 <hr/>

It will be obvious that, with the exception of reserved areas, some change in the various categories may come through experience. The categories are defined on currently available data and their reasonable extrapolation. Although greater certainty



could be obtained by replicated experimentation on an operational scale over all sites and forest types, only practice is likely to reveal the full range of problems and appropriate solutions; some faith in future generations of foresters is warranted. Certain facets of management such as the appropriate proportion of softwoods to hardwoods in the restocked forest require a knowledge of processing proposals for their final determination. Similarly, the likely economics, and thus intensity, of plantation and indigenous forest management can be determined only when the economics of the complete processing proposal have been examined. The approach has been then that the broad framework of forest management proposals should be established first (together with the size of the wood resource) and the detail resolved in association with industry.

### REACTION TO PROPOSALS

In the Forest Service report to government on proposals for the utilization of beech forests, it was stated that "the economic well-being of New Zealand and the preservation of its unique natural features both depend on wise use of the land. Neither may be accorded a higher priority than the other as of right, nor is there any simple means of arriving at the optimum balance between development and growth on the one hand and preservation of natural resources on the other. Where there is a major conflict the choice between economic welfare and what is commonly referred to as the quality of life is one for informed public decision. In the case of the South Island beech forests there should be no such major conflict, since the areas involved are large enough to accommodate both interests. The Forest Service believes that, provided the necessary safeguards are adopted, economic growth and the maintenance of environmental values are here compatible".

As this was the first attempt at placing a major forest development proposal before the public, the reaction has been of considerable interest. The main vehicle for outlining proposals was a report to Parliament (printed copies of which were available to the public), but explanations and inspections were arranged for members of Parliament, government departments with scientific and biological responsibilities, the New Zealand Institute of Foresters, the Royal Forest and Bird Protection Society of New Zealand; water catchment authorities, and the Nature Conservation Council. The comments received from these bodies were factual, useful, and generally constructive; most did not raise major objections to the proposals. The Royal Forest and Bird Protection Society, New Zealand's largest conservation society, while strongly opposing the replacement of beech with exotic forests, did not object to the use of the beech forests provided they were regenerated. Otherwise criticism centred around the need for a greater research effort — as a basis for delineating reserves, for gauging the effects of logging on soil and water values and for predicting the ecological effects of large-scale conversion to exotic species.

Despite the effort to present the proposals as fully as practicable to the general public, criticism from some sectors was subjective, uninformed, and emotive. The current wave of interest in environmental matters has produced a reaction which manifests itself in a commonplace suspicion that any interference with the natural order is prompted solely by an indefensible desire for material gain. In its extreme form this belief results in complete opposition to use of the native forests for new industry and an unwillingness to accept that a balance could be struck to cater for the various human needs provided by the forest estate. To foresters charged with meeting these needs, and in fact trained specifically to do so, the awakened public interest is a welcome change from the apathy that has in the past distinguished public reaction to major forest policy statements.

At the same time, there is disappointment that in many instances members of the public have either not sought to obtain the basic facts or have seized only upon those which support a preconceived opposition to logging native forests and to converting part of the logged forest to exotic plantations. It is apparent that the concept of forests as renewable resources capable, with proper management, of satisfying a variety of human needs has not been well conveyed by the forester to the layman. It is to be hoped that more frequent contact and airing of views will lead to increased maturity of outlook on both sides.